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### (54) Engine block for an internal combustion engine

(57) An engine block (10) is disclosed having machined front and rear faces. Each of the front and rear faces is capable of receiving and sealing against a housing (20,40) enclosing a gear train for coupling the engine crankshaft to a camshaft (30) of the engine. The front face is additionally capable of directly receiving and sealing against an engine front cover (64) while the rear face is additionally capable of directly receiving and sealing against a flywheel housing (62). In this way, the same engine block may be selectively assembled into an engine having a front mounted or a rear mounted camshaft gear train.

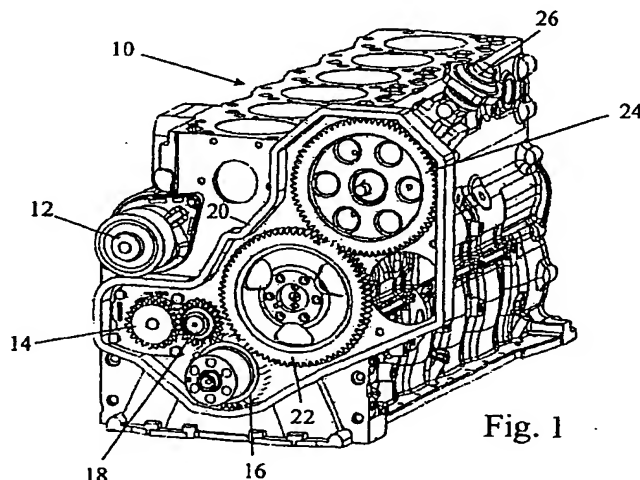


Fig. 1

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## Description

[0001] The present invention relates to an internal combustion engine and is particularly concerned with the design of the engine block of large capacity engines as used in trucks and agricultural vehicles.

[0002] The gear train that drives the camshaft from the crankshaft in an internal combustion engine can be mounted either at the front end or the rear end of the engine. The rear of the engine refers to the end connected to the vehicle drive train, i.e. the end on which the flywheel and gearbox are mounted. From the point of view of reducing noise, the rear mounted drive train configuration is to be preferred but packaging considerations may dictate that the drive train be positioned at the front of the engine.

[0003] Hitherto, a manufacturer producing variants of the same engine having front and rear camshaft gear trains needed to produce two totally different engine blocks. This added to manufacturing costs.

[0004] It is therefore an object of the present invention to provide an engine block which allows the use of both front and rear camshaft gear trains.

[0005] According to the present invention, an engine block is provided having machined front and rear faces, wherein each of the front and rear faces is capable of receiving and sealing against a housing enclosing a gear train for coupling the engine crankshaft to a camshaft of the engine, and wherein the front face is additionally capable of directly mating with and sealing against an engine front cover and the rear face is additionally capable of directly mating with and sealing against a flywheel housing, whereby the same engine block may be selectively assembled into an engine having a front mounted or a rear mounted camshaft gear train.

[0006] As the size and shape of the drive train housing will usually differ from the size and shape of the engine front cover, or the flywheel housing, as the case may be, the front and rear faces of an engine block will have machined sealing surfaces and holes for receiving fastening elements that are redundant in any selected camshaft gear train configuration.

[0007] In the present invention, the same engine block can be sent to different assembly lines for the manufacture of engines having both front mounted and rear mounted gear trains. This results in a considerable cost saving, avoiding the need for separate castings for the different engine variants.

[0008] In order to be able to mount the gear or cog driving the camshaft at either end of the engine, it is important that there should be fixings provided at both ends of the engine to receive an axial thrust bearing plate to limit the axial displacement of the camshaft. It is possible to use these fixings at the front end of the engine to secure the front cover to the engine block when the camshaft gear train is mounted at the rear of the engine.

[0009] It is preferred to provide a water pump fixing at the front end of the engine and to mount a belt driven water pump at the front end of the engine, regardless of the position of the camshaft gear train.

[0010] It is further preferred to provide fixings for mounting a gear driven oil pump at the front end of the engine to be driven from the front end of the engine crankshaft, regardless of the position of the camshaft gear train.

[0011] To facilitate the introduction of the camshaft into the engine block from either end of the engine and to enable the same camshaft to be used in both gear train configurations, it is preferred to provide bushed cam journals at both ends of the engine for supporting the camshaft.

[0012] It is also desirable to be able to reverse the oil pan and to this end it is advantageous to provide a symmetrical bolt pattern on the underside of the engine.

[0013] The camshaft gear train, in both engine configurations, may additionally include means for driving ancillary equipment, such as a mechanical fuel pump, a hydraulic pump or a power steering pump.

[0014] The invention will now be described further, by way of example, with reference to the accompanying drawings, in which :

Figure 1 is a front perspective view of an engine comprising a block of the engine and a front mounted camshaft gear train;

Figure 2 is a rear perspective view of an engine comprising a block of the engine and a front mounted camshaft gear train;

Figure 3 is a front perspective view of an engine comprising a block of the engine and a rear mounted camshaft gear train;

Figure 4 is a rear perspective view of an engine comprising a block of the engine and a rear mounted camshaft gear train;

Figure 5 is a view from below of an engine having a front mounted camshaft drive train housing;

Figure 6 is a view from below of an engine having a rear mounted camshaft drive train housing; and

Figures 7 and 8 are side views of two different engine variants having oil pans mounted on them in opposite ways.

[0015] The drawings show two engines assembled using the same engine block 10. The engine of Figures 1 and 2 has a front mounted camshaft gear train housing 20 while the engine of Figures 3 and 4 has a rear mounted camshaft gear train 40.

[0016] The gear train housings 20 and 40 used in the two configurations are clearly not the same. When the camshaft gear train housing 20 is positioned at the front of the engine, it only needs to receive an access panel whereas the gear train housing 40 that fits at the rear of the engine must receive the flywheel housing and permit a flywheel to be mounted on the crankshaft.

[0017] The engine block 10 is nevertheless designed to optimise the number of components that can be used in both engine variants. Hence, in both engine variants, a water pump 12 is mounted on the front end of the engine to be driven by a belt from a pulley (not shown) mounted on the front end of the crankshaft. Furthermore, a gear driven oil pump 14 is mounted on the front end of the engine which in both engine variants is driven by a gear 16 fitted to the crankshaft and acting on the oil pump drive gear through an idler gear 18.

[0018] The front face of the engine block 10 receives the housing 20 of the camshaft gear train in the manner shown in Figure 1. The bolt pattern and sealing surfaces that enable the housing 20 to be mounted on the engine block 10 are better shown in Figure 3. The front mounted camshaft gear train comprises a gear 22 directly meshing with the gear 16 on the crankshaft and a further gear 24 that meshes with the gear 22 and drives ancillary equipment, such as a mechanical fuel pump 26.

[0019] As shown in Figure 2, in which the camshaft gear train housing 20 is mounted at the front of the engine, the rear face of the engine has a machined surface and a bolt pattern to enable the flywheel housing to be directly bolted to the engine block 10. A collar 32 formed integrally with the crankshaft has bolt holes for mounting a flywheel next to the rear face of the engine.

[0020] Identical journal bearings 34 for the camshaft 30 are used at both ends of the block and there are bolt holes surrounding the camshaft journals at both ends of the block to mount a plate for resisting axial thrust on the camshaft.

[0021] The sealing surfaces and the bolt hole pattern on the rear face of the engine also allow the camshaft gear train housing 40 to be mounted on it in the manner shown in Figures 3 and 4. The rear mounted camshaft gear train housing 40 has some fastening holes to allow it to be mounted to the engine block 10 and other holes that allow the flywheel housing to be bolted through it to the engine block 10.

[0022] The rear mounted camshaft gear 22 can be the same as the one that fits the front end of the camshaft but in this case a gear 50 must be fitted on the crankshaft behind the collar 32. This can be achieved by heat shrinking the gear 50 and the collar 32 on the crankshaft. The gear 22 can also mesh with further gears, such as the gear 52, to drive ancillary equipment such as a hydraulic pressure pump or a power steering pump.

[0023] In the variant in which the drive train housing 40 is fitted to the rear of the engine, the front face (shown in Figure 3) can receive a front cover that fits only over the gears 14, 16 and 18 and the front end of the camshaft 30. Such a cover will use some of the bolt holes provided for the front drive train housing 20 but as it is smaller than the housing 20, there will also be some sealing surfaces and bolt holes that are redundant.

[0024] As shown in Figures 5 to 8, different variants of the engine based on the engine block of the invention can all be designed to receive the same oil pan and the oil pan can be mounted with different orientations.

[0025] Thus in Figure 5, the oil pan 60 overlaps the gear housing 20 at the front end of the engine and the flywheel housing 62 at the rear, whereas in Figure 6 the same oil pan overlaps the engine front cover 64 at the front of the engine and the rear mounted gear housing 40 at the rear. To this end, the oil pan mounting holes in the front mounted gear housing 20 should match the bolt pattern in the engine front cover 64. Similarly, the bolt pattern in the rear mounted gear housing 40 should match that in a seal carrier 66 that is mounted beneath the flywheel housing 62 in the variant with a front mounted gear train housing 20.

[0026] As shown in Figures 7 and 8, the oil pan 60 has a deeper section and a tray that slopes towards the deeper section. The bolt patterns on the underside of the engine and on the oil pan are symmetrical so that the deep section of the oil pan may either be located at the rear of the engine (as shown in Figure 7) or at the front of the engine (as shown in Figure 8).

## Claims

1. An engine block (10) having machined front and rear faces, and characterized in that :
  - each of the front and rear faces is capable of receiving and sealing against a housing (20, 40) enclosing a gear train for coupling the engine crankshaft (-) to a camshaft (30) of the engine; and
  - the front face is additionally capable of directly mating with and sealing against an engine front cover (64) and the rear face is additionally capable of directly mating with and sealing against a flywheel housing (62), whereby the same engine block (10) may be selectively assembled into an engine having a front mounted or a rear mounted camshaft gear train.
2. An engine block according to claim 1, characterized in that the front and rear faces have machined sealing surfaces and holes for receiving fastening elements that are redundant in any selected camshaft gear train configuration.
3. An engine block according to claims 1 or 2, characterized in that fixings are provided at both ends of the engine to receive an axial thrust bearing plate (-) to limit the axial displacement of the camshaft.
4. An engine block according to claim 3, characterized in that the fixings at the front face of the engine for

receiving an axial thrust bearing plate are suitable to receiving a front cover (64) overlying the end of the camshaft (30) and the front end of the crankshaft.

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5. An engine block according to any of the preceding claims, characterized in that a water pump fixing is provided only at the front end of the engine.

6. An engine block according to any of the preceding claims, characterized in that the engine block further comprises fixings for mounting a gear driven oil pump (14) only at the front end of the engine to be driven from the front end of the engine crankshaft.

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7. An engine block according to any of the preceding claims, characterized in that bushed cam journals (34) are provided at both ends of the engine for supporting the camshaft (30).

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8. An engine block according to any of the preceding claims, characterized in that the engine block has a symmetrical bolt pattern for mounting an oil pan (60) on the underside of the engine.

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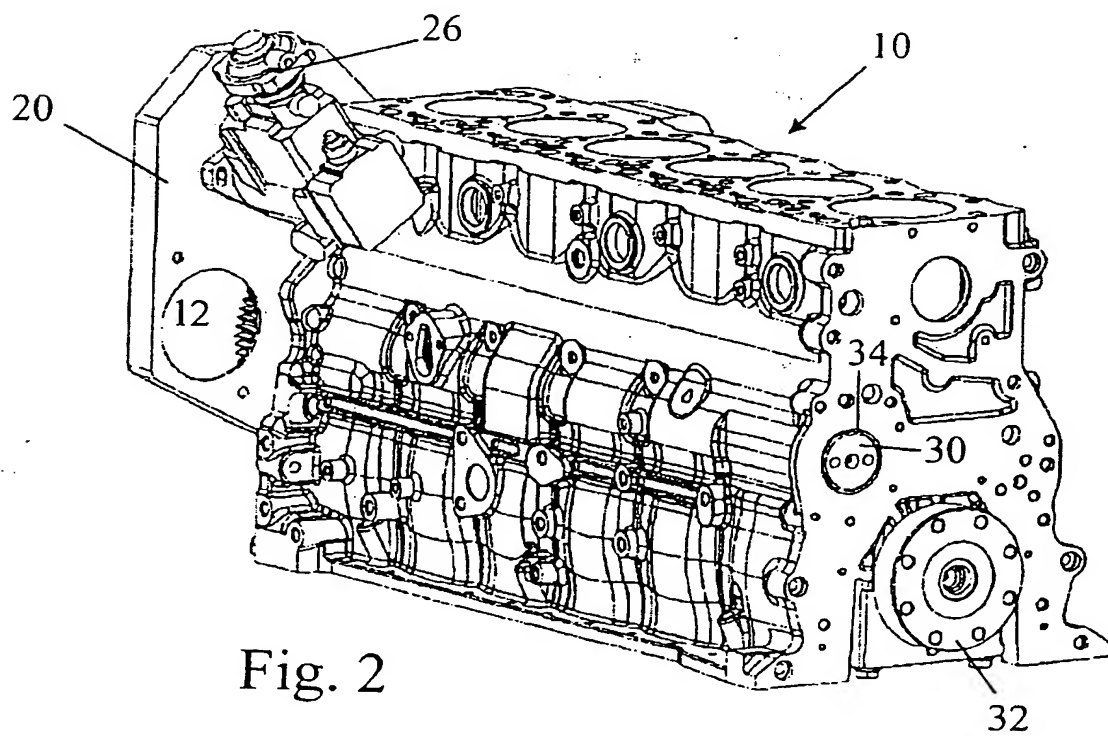
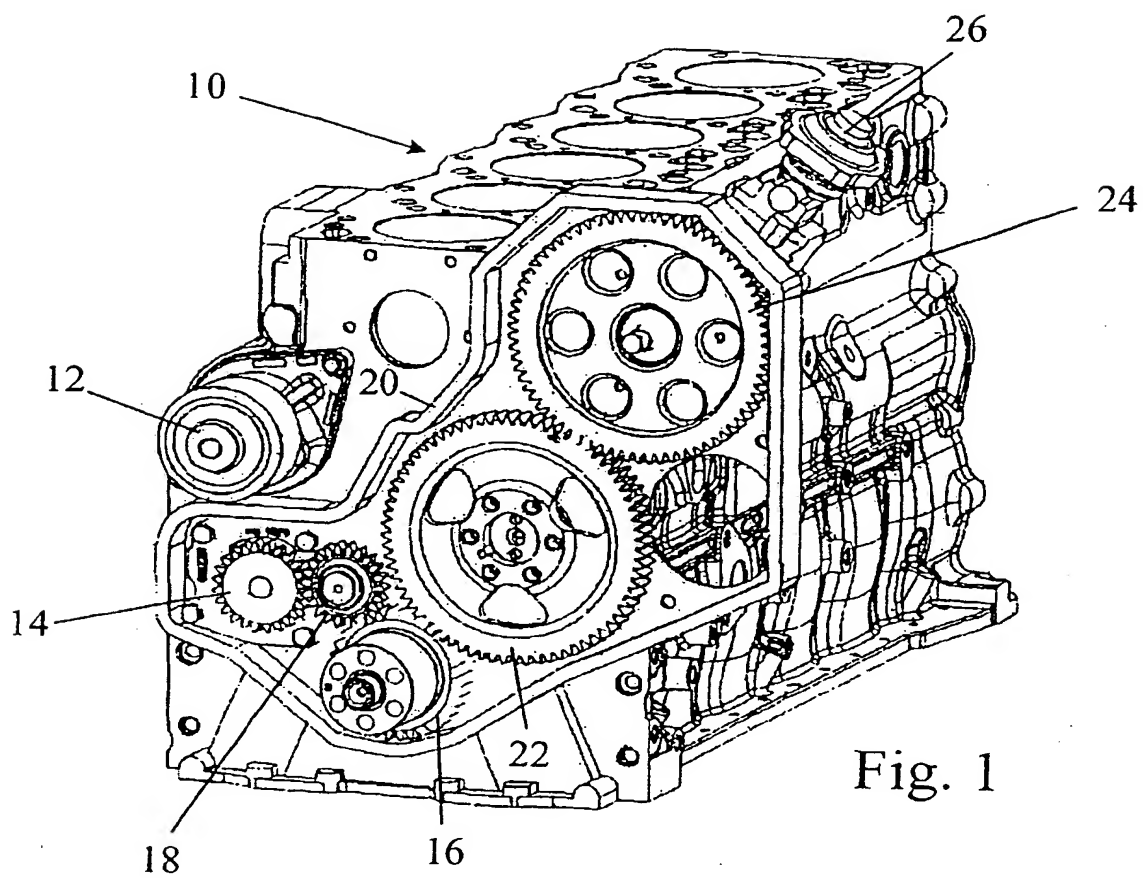
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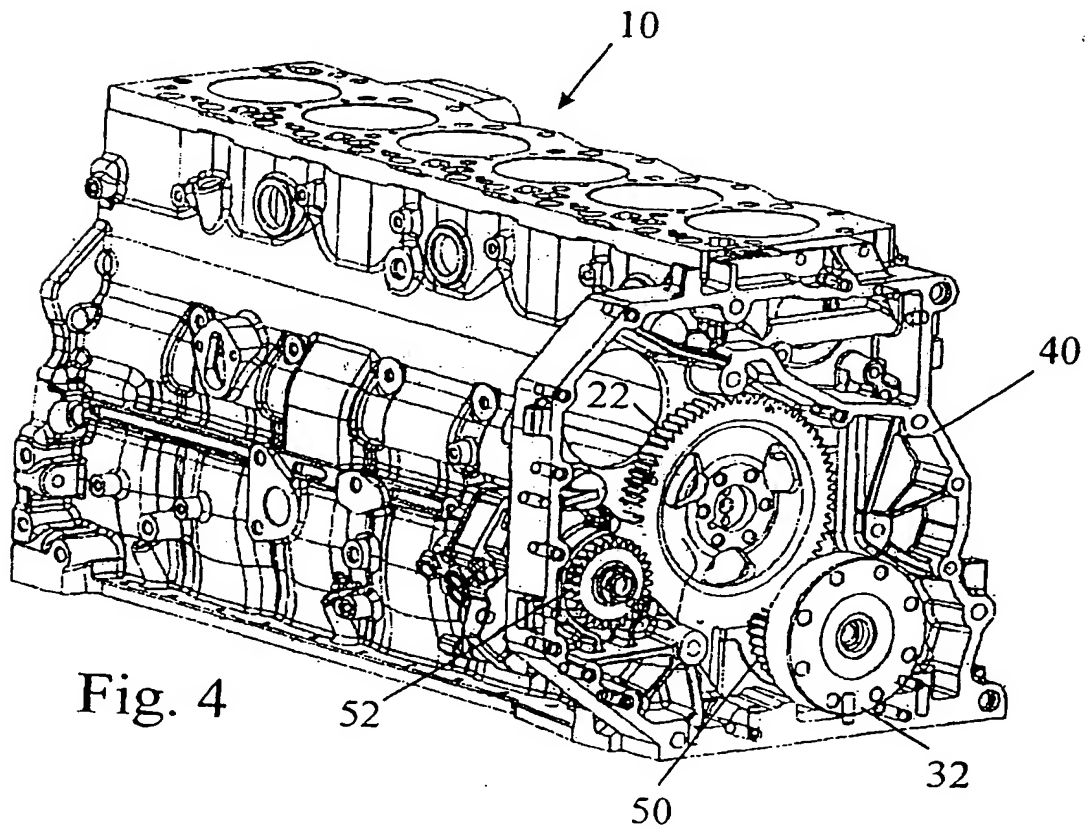
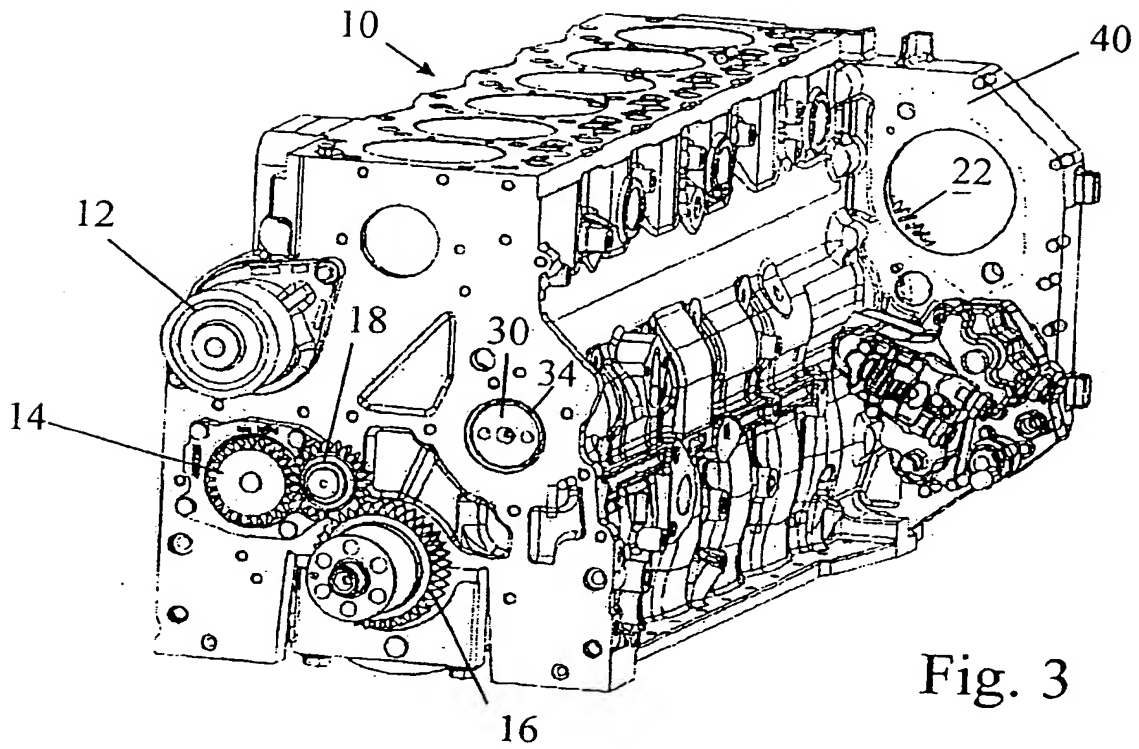
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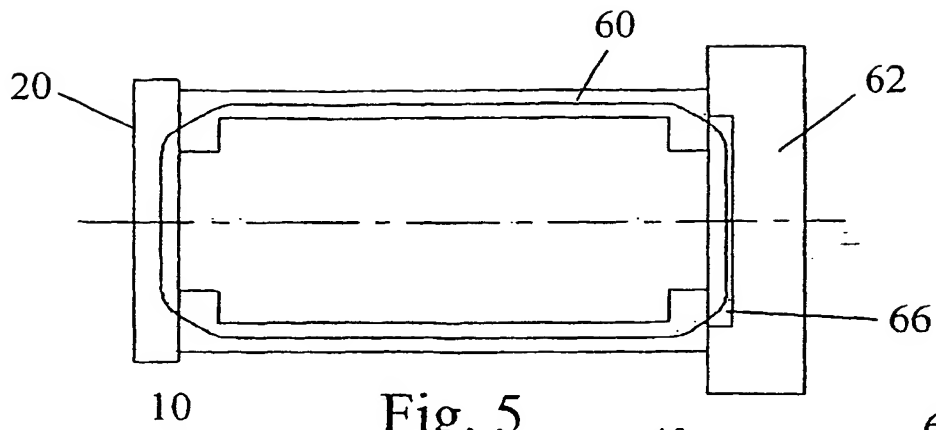


Fig. 5

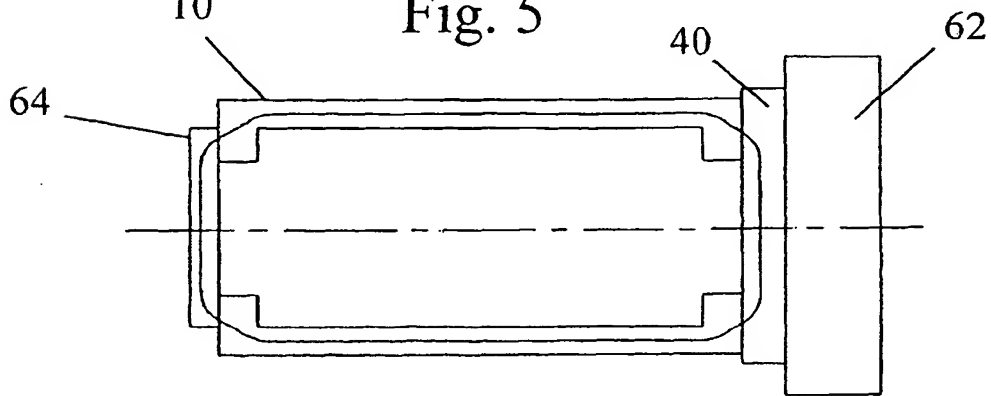


Fig. 6

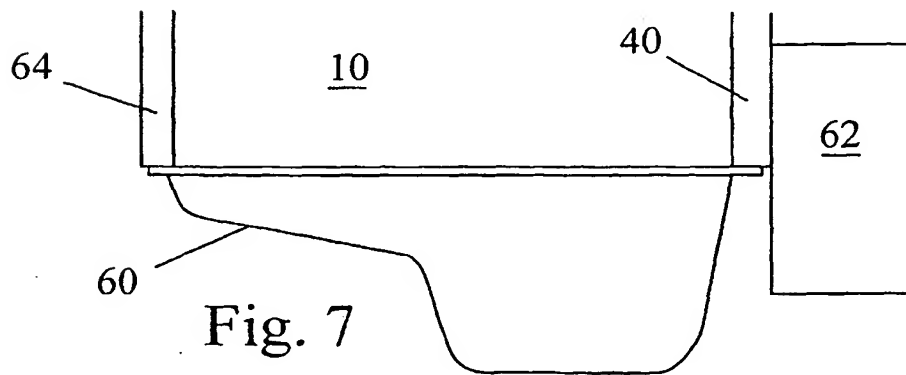


Fig. 7

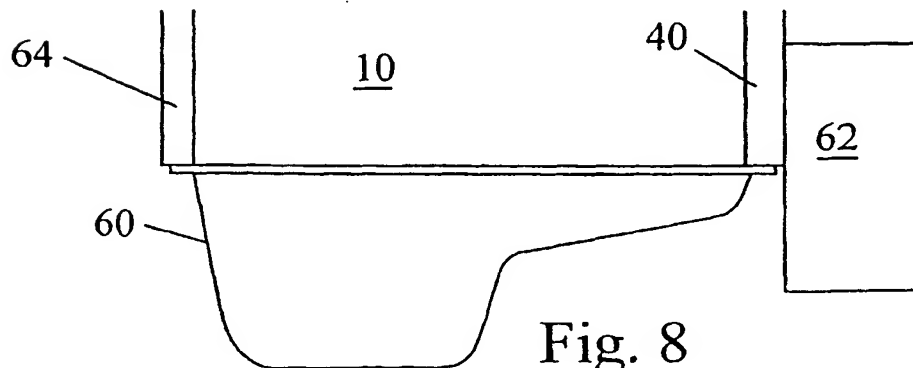


Fig. 8

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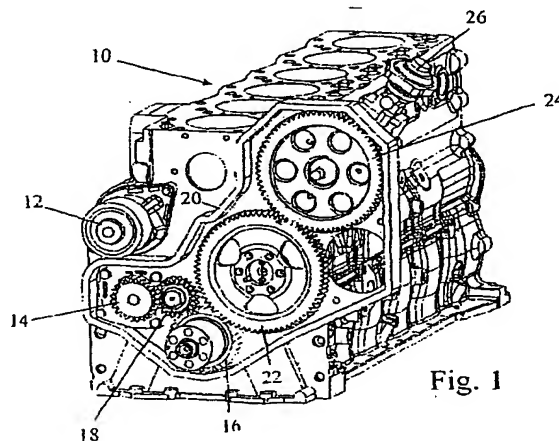


Fig. 1





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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 20 2795

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	FR 694 337 A (MORRIS COMMERCIAL CARS LTD) 2 December 1930 (1930-12-02) * figures 1-9 * * page 1, line 1 - line 48 * * page 2, line 22 - line 52 * * page 3, line 25 - line 51 *	1-4, 7, 8	F02F7/00 F01L1/02 F02B69/00
A	EP 0 705 964 A (YAMAHA MOTOR CO LTD) 10 April 1996 (1996-04-10) * figures 1-16 * * abstract * * claims 1-8 *	5	
A	GB 1 317 040 A (CUNEWALDE MOTOREN) 16 May 1973 (1973-05-16) * figure 1 * * page 1, line 1 - line 95 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>7 February 2002</b>	Examiner <b>Wassenaar, G</b>
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  L : earlier patent document but published on, or after the filing date  I : document cited in the application  E : document cited for other reasons  &amp; : member of the same patent family, corresponding document</p>			

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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